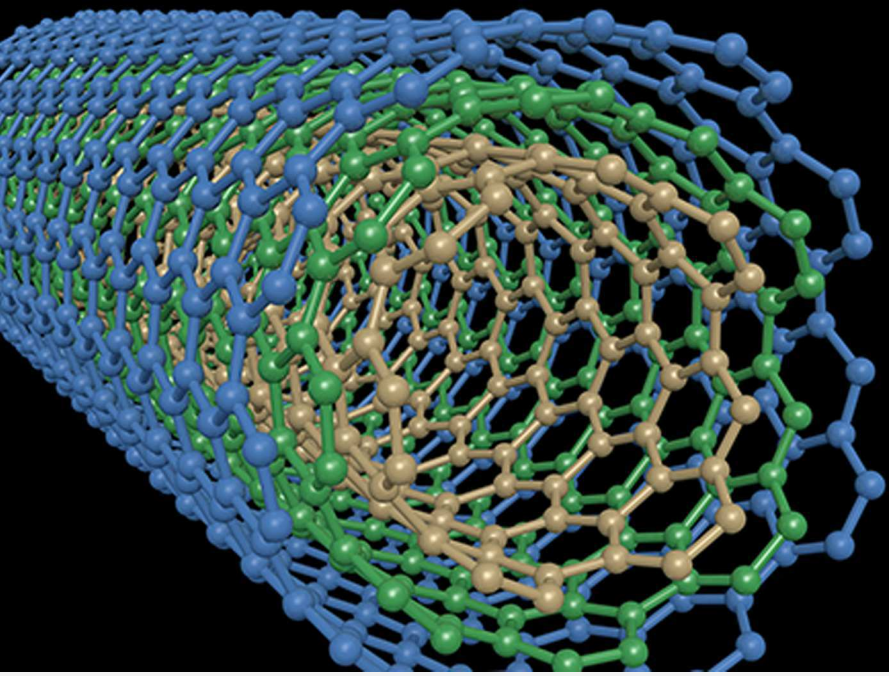

National Aeronautics and Space Administration

Health, Medicine and Biotechnology

Carbon Nanotube Bucky Paper Cages For Immune Shielding Of Cells And Tissue For Transplantation

Fabrication and use of Carbon Nanotube Buckypaper (CNTBP) cages for immune shielding

NASA has patented a new technology that may prevent the rejection of transplanted cells and tissues. The human immune system identifies and rejects non-host cells and tissues with high efficiency. The new invention involves the fabrication and use of Carbon Nanotube Buckypaper (CNTBP) cages for immune shielding. This approach promotes and supports a variety of useful biological processes that are difficult or impossible when cells or tissue are maintained in culture outside the body. It allows for the transplantation of cells or tissues from unrelated donors or from unrelated species (xenografts) into host subjects with dramatically reduced potential for rejection and/or the use of immunosuppressive therapies, which can be highly toxic. Current strategies for islet cell transplantation, for example, have shown marginal success due to limited graft survival, even with immunosuppressive therapy.

BENEFITS

- Biocompatibility
- Ease of engineering to create a variety of shape and forms
- Cage material allows the cells and tissues to be maintained in a live and functioning state
- Cage material does not provoke an immune response, does not elicit scar formation, and resist protein deposition
- Cage material is flexible and resilient
- Ability to control the dimensions of the cage
- Optimize the transport of metabolic substances into and out of the cage
- Potential to modify the material
- Allows transplantation of cells or tissues from unrelated donors/species into host subjects without potential for rejection, immunosupressive drugs etc.

technology solution

THE TECHNOLOGY

The buckypaper cage concept provides construction of one or more cages, envelopes, enclosures or receptacles (referred to collectively herein as a "cage"), made primarily of Carbon Nanotube Buckypaper (CNTBP) a strategy for transplanting multiple types of cells and tissue in various applications and environments. The biological material would be placed in a structure - a cage - that promotes desirable characteristics like immune shielding, physical structure, porosity, and bio-compatibility. The innovation may also be used to provide a micro-environment (within the human or other host body), in which temperature, pH, oxygen levels, carbon dioxide levels, nutrient levels, metabolite levels, and levels of cytokines and other regulatory molecules (including molecules that may not be characterized) are optimum, to permit differentiation of cells or the assembly of tissue structures for later use in tissue engineering applications. The immune shield cage might also be configured to perform "sensing" and "secretion" functions, where certain molecules trigger the release of desired substances and control the biological functioning of the material inside the cage. Chemical modification of the cage material is also possible in order to suit the particular environment or application and to obviate the need for immunosuppressive drugs.

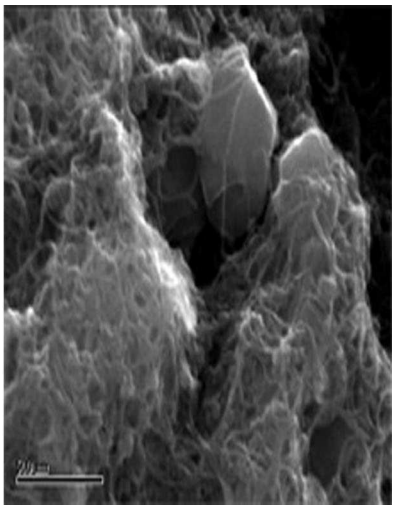

Image of carbon nanotube based buckypaper. Bundles of single-walled nanotubes may be seen on the surface of the buckypaper.

APPLICATIONS

The technology has several potential applications:

- Astromedicine
- Space missions
- Healthcare
- Islet cell transplantation
- Cytokine therapy
- Endocrinology
- Tissue engineering
- Immune therapy
- Gene therapy
- Neurological tissue
- Orthopedic applications

PUBLICATIONS

Patent No: 7,070,923

More Information

National Aeronautics and Space Administration

Technology Partnership Office

Ames Research Center

MS 202A-3
Moffett Field, CA 94035
855-627-2249
ARC-TechTransfer@mail.nasa.gov

http://technology.nasa.gov/

www.nasa.gov

NP-2015-02-1398-HQ

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

ARC-15088-1